

04 May 2000

COMMAND MANAGEMENT REVIEW (CMR)

Maintenance Management Performance Indicators

REFERENCE:

- Consolidated Command Guidance 2000
(<http://www.usace.army.mil/inet/function/rm/rmpg/rmpg.htm>)
- ER 750-1-1, Materiel Maintenance Policies
(<http://www.usace.army.mil/inet/usace-docs/eng-regs/er.htm>)
- EP 750-1-1, Procedural Pamphlet for Materiel Maintenance Policies
(<http://www.usace.army.mil/inet/usace-docs/eng-pamphlets/ep.htm>)

PURPOSE:

To provide a general procedure for reporting Command Management Review (CMR) related maintenance data from the Division, Laboratories, Centers, and Field Operating Activities (FOA) level, for the purpose of meeting CMR reporting requirements and criteria. The equipment effected will have an acquisition value (not cost) of \$5,000 or greater when acquired. The CMR indicators are:

- Equipment maintenance cost (parts/labor)
- Equipment operational (availability) rates
- Equipment maintenance backlog

Command Management Review (CMR) Reporting Periods are as follows:

- (1) First Quarter: 1 OCT through 31 DEC = 92 possible days.
- (2) Second Quarter: 1 JAN through 31 MAR = 90 possible days (add one day for leap year).
- (3) Third Quarter: 1 APR through 30 JUN = 91 possible days.
- (4) Fourth Quarter: 1 JUL through 30 SEP = 92 possible days.

Command Management Review (CMR) for materiel maintenance management will be initiated using a two phased approach. Phase one will include the four broad equipment categories, **Watercraft, Construction, Material Handling** and **Support**. This property is further defined at appendix (A). Phase two of this effort will begin at a later time to be determined (TBD) and will include items of civil works equipment, such as, individual generators (powerhouses), and individual pumps (pumping stations).

Maintenance management performance indicators: *are required to control maintenance cost while increasing maintenance productivity. Indicators show where your maintenance program is and where it is going. They provide a quick, accurate performance assessment of a Materiel Maintenance Management Program (MMMP) and a measure of productivity, as well as a means of providing feedback for corrective action.*

Each USACE activity will use maintenance indicators to aid in attaining effective measures to improve performance in Materiel Maintenance Management functions. There are three common indicators that will be very beneficial when they are used within the USACE business process. We will gain certain advantages once we begin to monitor and record equipment maintenance cost (parts and labor), equipment operational (availability) rates, and equipment maintenance backlog . At that time we will be able to analyze data that will help us improve the performance and efficiency of the MMMP.

The importance of maintaining accurate maintenance data records cannot be over emphasized, once the Facilities and Equipment Maintenance (FEM) system is fielded this requirement will be invisible to the field. It will be the responsibility of the field to ensure that all required maintenance data is entered into the FEM system, the headquarters will have the capability to pull CMR data directly from the database. Please ensure that all requested data is submitted in the format as prescribed by the three enclosed forms, Equipment Maintenance Cost (Parts & Labor) enclosure 1, Equipment Operational (Availability) Rates, enclosure 2, Equipment Maintenance Backlog, enclosure 3.

We can expect no improvements in maintenance operations without reliable data. Commanders and managers should rely on this type data to measure and improve the effectiveness of the MMMP in the Corps. Taken collectively, these indicators provide materiel maintenance managers the required tools to perform effective, efficient, and comprehensive life cycle MMMP activities. The ultimate goal of all our efforts is to field, operate, maintain, and sustain the range and depth of equipment adequate to perform our missions at the lowest life cycle cost of ownership.

A typical MMMP is likely to encompass several sub categories of maintenance. This maintenance might be grouped into any or all of five types, including **Preventive Maintenance (PM), Predictive Maintenance (PdM), Repair Maintenance (RM), Rebuild Maintenance (RbM), and Modification (MM)**. USACE will now begin to focus on collecting all MMMP data by these categories. This will require that block 5, of DA Form 2407-maintenance request, be annotated in the future to indicate the type maintenance requested, by using the two or three letter code, as shown in parenthesis above.

DEFINITIONS:

Preventive Maintenance: All actions performed in an attempt to retain an item in a specified condition by providing systematic inspection, detection, and prevention of incipient failures.

Predictive Maintenance: Using technologies such as vibration analysis, infrared thermograph, used oil analysis, ultrasound detection, and motor circuit analysis to detect abnormal conditions and impending failure. This technique can minimize the need for disassembly and inspection of internal parts.

Repair Maintenance: The restoration or replacement of parts and or assemblies to maintain efficient operating conditions.

Rebuild Maintenance: To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements using original manufacturing tolerance, specifications and the subsequent re-assembly of the item.

Modification: Any maintenance actions taken to change or modify the form, fit, function and life expectancy of a standard item of equipment.

1. Equipment Operational (Availability) Rate. An operational rate is also a helpful indicator to diagnose the level of performance for a MMMP. The rate is a mathematical expression of up time for equipment versus down time, and is displayed as a percentage of total time. This numerical relationship is known as Operational Availability and refers to the equipment readiness goals that are set for USACE activities to attain.

USACE has set operational criteria or a goal for all Command activities to strive for or surpass. Our goal is to achieve an equipment operational readiness rate that is 85 per cent or higher. Equipment readiness will be measured using colors to designate specific numeric ranges or degrees of equipment readiness. Green is 85 percent or higher, Amber is 75 to 84, and Red is 74 percent or lower.

Formula:
$$\frac{\text{Available Days}}{\text{Possible Days}} \times 100 = \text{Operational Rate}$$

Example: To compute the Operational Rate: first divide available days by possible days. Then multiply the resulting decimal (fraction) by 100 to convert it to a percentage, i. e., when we have one equipment item with 82 available days, and 91 possible days, the equation would be: $82/91 = .901 \times 100 = 90.1 \%$.

2. Equipment Maintenance Cost (Parts & Labor). Chapter 5, of ER 750-1-1 explains the importance of collecting, recording, and using historical maintenance cost information as part of a superior MMMP. USACE activities will document maintenance cost utilizing the provisions contained in an automated maintenance management system, or DA Form 2409, Equipment Maintenance Log. Use Section B of the form (Maintenance Inspection Record) to record service, test, and inspections, and Section C (Repair and Cost Record) to record all other type maintenance except Modifications. Section D is used to record this maintenance category. In each case, care should be taken to record entries for total parts and total labor for each maintenance category, as appropriate.

Life cycle costing attempts to identify projected personal property related expenditures, using the acquisition to retirement approach. As such, its focus considers maintenance costs from the time of equipment acquisition, until disposal. An aggressive PM program goes a long way toward reducing total life cycle equipment maintenance costs. As an example, almost without exception, it is far more cost effective to expend PM dollars than to wait for an equipment failure before taking action. Industry experience has shown that certain ratios and percentages of total equipment maintenance budget, versus expenditures by category, can send management clues on where MMMP performance can improve. Some industry maintenance experts advise the following values as reasonable goals for a quality MMMP performance:

Preventive Maintenance (PM).	Target: 35 per cent
Predictive Maintenance (PdM).	Target: 15 per cent
Repair Maintenance (RM).	Target: 20 per cent
Rebuild Maintenance (RbM).	Target: 20 per cent
Modification (MM)	Target: 10 per cent

In all situations pertaining to the MMMP, all USACE activities are required to take appropriate actions so that permanent records are made to document all MMMP operation expenditures in a manner that enables all management levels and higher organizations to perform thorough analyses and evaluations as desired. As previously stated, we must now begin to emphasize data collection by the five MMMP categories above.

$$\text{Formula: Preventive Maintenance Cost} = \frac{\text{Preventive Maintenance Cost}}{\text{Total Equipment Maintenance Budget}} \times 100$$

= PM percent compared to Total Equipment Maintenance Budget

The above formula can be used for all five maintenance categories)

3. Equipment Maintenance Backlog. We may also gauge the level of performance effectiveness and efficiency in a maintenance program by monitoring the scheduled and unscheduled maintenance actions that are incomplete at the end of the quarter. As an example, we may wish to focus on maintenance backlog in terms of hours of scheduled and unscheduled maintenance for the five categories listed below: Our measurement would examine the ratio of maintenance hours that remained incomplete compared to maintenance hours scheduled (planned).

USACE has establish a goal of 15 percent or less for maintenance backlog. Maintenance backlog will be depicted using colors for specific numeric ranges or percent of maintenance backlog. Under this system, Green = 15 percent or less, Amber = 16-20 percent, and Red = 21 percent or higher. Backlog is the ratio of maintenance hours that remain incomplete at the end of the quarter compared to completed maintenance hours scheduled (planned) at the beginning of the quarter.

We can determine planned maintenance hours at the beginning of the quarter, by summation of maintenance hours required to complete all scheduled maintenance during the quarter, and adding additional maintenance hours required as a result of unscheduled maintenance that arise during the quarter). **Example:**

Category of maintenance	Maintenance Hours Scheduled	Maintenance Hours Unscheduled	Maintenance Hours Incomplete
Preventive Maintenance (PM).	2050	0	300
Predictive Maintenance (PdM).	500	0	50
Repair Maintenance (RM).	0	400	40
Rebuild Maintenance (RbM).	0	500	80
Modification (MM)	<u>0</u>	<u>150</u>	<u>0</u>
Total	2550	1050	470

Formula:
$$\frac{\text{Maintenance_Hours_Incomplete}}{\text{Total Maintenance Hours (Scheduled + Unscheduled)}} \times 100 = \text{Backlog}$$

Example: $470 / 2550 + 1050 = 470 / 3600 = 0.1305 \times 100 = 13.05\%$ (Green)

NOTE: *This data when properly documented could be used to support justification for additional resources if required.*

List of USACE Maintenance Significant Property for CMR reporting (Appendix, A)

Item No.	End Item Code (EIC)	Nomenclature	Federal Supply Class
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WATERCRAFT

LAD	Barge, deck cargo	1930
LAF	Barge, fuel/oil	1935
LAH	Barge, hopper	1935
LAM	Barge, mooring	1930
LAP	Barge, pipeline, float/pontoon	1935
LAR	Barge, revetment/mat sinking	1935
LAS	Barge, dump/scow	1935
LAQ	Barge, quarters/office	1935
LAW	Barge, work, shop/service	1935
LEO	Towboats (inland style)	1925
LEU	Tugboats (model bow)	1925
LFD	Vessel, debris collecting	1940
LFL	Vessel, launch/inspection/patrol	1940
LFS	Vessel, survey	1940
LFU	Vessel, utility boats(under 20 Ft)	1940
LG*	Outboard propelling unit	2805
LHB	Crane barge, bank grader	1935
LHC	Crane barge, crawler	1935
LHM	Crane barge, mobile	1935
LHS	Crane barge, stiff leg/derrick	1935
LIM	Floating crane, marine revolver	1935
LIP	Floating crane, pedestal mounted	1935

CONSTRUCTION EQUIPMENT :

EH3	Scraper, earth moving,	3805
EA5	Tractor, full tracked, engine driven, w/bulldozer	2410
EDW	Tractor, wheel industrial,	2420
EHA	Grader, road motorized	3805
EKY	Crane, wheel mounted,	3810
EKM	Crane, truck mounted	3810
EMK	Crane, crawler mounted	3810
ELB	Crane shovel, truck mounted	3810
EMA	Crane shovel, crawler mounted,	3810
EPB	Shovel, front crane, crawler mounted	3810
EN4	Backhoe crane-shovel,	3810

E2*	Excavator, multipurpose, crawler mounted	3805
E2Y	Excavator, multipurpose, truck mounted	3805
EF6	Loader, scoop type, full tracked, engine driven	3805
EFH	Loader, scoop type, wheel, engine driven	3805
EXB	Compactor, high speed, tamping self propelled	3895
ETM	Roller, towed	3895
EUK	Roller, towed vibrating, engine driven	3895
EUC	Roller, motorized, engine driven	3895
E36	Auger, earth, full tracked, engine driven	3820
EU4	Auger, earth, skid mounted, engine driven	3820
E3N	Auger, earth, truck mounted, engine driven	3820
E23	Ditching machine, engine driven, crawler/wheel mounted	3805
ETA	Ditching machine, engine driven wheel mounted ladder	3805
E9G	Hammer, pile driver, self-propelled	3815
E9C	Drill, pneumatic drifter, crawler mounted	3820
EX3	Distributor, water, tank type, engine driven, truck mtd	3825
EVY	Mixer, rotary tiller diesel driven self-propelled	3895
EVA	Sweeper, rotary, towed, engine driven	3825
	Extractor, piling	3815

SUPPORT EQUIPMENT :

VC2	Generator set, engine driven	6115
FBA	Pneumatic tool and compressor outfit, trailer mounted	4310
FBC	Pneumatic tool and compressor outfit, truck mounted	4310
DWF	Compressor, unit, rotary air, trl mtd, engine driven	4310
DWJ	Compressor unit, rotary air, whl mtd, engine driven	4310
DWV	Compressor unit, rotary, gas, truck mounted	4310
ZC6	Pump, centrifugal, engine driven,	4320
ZHA	Pump, reciprocating, engine driven	4320
2AA	Welding Machine, Skid Mounted	3431
FRC	Snow removal, self propelled, engine driven	3825
ED2	Tractor, wheel agriculture, engine driven	2420
FDS	Platform lift, scissors type	
ED*	Tractor, mower, lawn	2420

MATERIAL HANDLING EQUIPMENT :

DC4	Crane truck, warehouse electric	3930
DC6	Crane truck, warehouse electric hydraulic	3930
DC*	Crane truck, warehouse, engine driven	3930
DA3	Truck, fork lift, electric	3930
DA4	Tractor, wheeled warehouse, electric,	3930
DMN	Tractor, wheeled warehouse, engine driven	3930
DNZ	Truck, fork lift, engine driven	3930
DN*	Truck, forklift, propane gas driven	3930